CLAIMS

We claim:

1   1.   A method comprising:

2   validating a header of a packet from a first checksum of the packet;

3   decrementing a time-to-live field of the header;

4   recalculating a second checksum of the header;

5   performing a route lookup; and

6   forwarding the packet,

7   wherein the validating a header, the decrementing a time-to-live, the recalculating

8   a checksum, and the performing a route lookup are performed only once

9   for the packet during transfer within a router.

1   2.   The method of claim 1, wherein the performing a route lookup further comprises:

2   determining a next-hop; and

3   determining an egress-port.

1   3.   The method of claim 2, wherein the forwarding further comprises:

2   forwarding the packet in reference to the egress-port.

1   4.   The method of claim 1, wherein the egress-port further comprises a local port on

2   the ingress-forwarding element, and the forwarding further comprises:

3   completing the encapsulation of the packet; and transmitting the packet over the

4   local-egress-port.

1   5.   The method of claim 1, wherein the egress-port further comprises a remote port,

2   and the forwarding further comprises:

3   forwarding the packet to the egress-forwarding element through an internal bus of

4   the router;

5   applying a label that corresponds to the egress-port and next hop;

6   determining the next hop and the egress-port on which the packet is to be

7   transmitted in reference to the switch-label;

8   removing the label;

9   completing the layer-2 encapsulation of the packet; and

10   transmitting the packet over the egress-port.

1   6.   A machine-accessible medium having associated instructions capable of directing

2   a machine to perform:

3   validating a header of a packet from the checksum of the packet;

4   decrementing a time-to-live field of the header;

5   recalculating a checksum of the header;

6   performing a route lookup;

7   determining an egress-port; and

8   forwarding the packet in reference to the egress-port of the packet,

9   wherein the validating action, the decrementing action and the recalculating

10   action are performed only once for the packet during transfer within a

11   router.

1   7.   The machine-accessible medium of claim 6, wherein the egress-port further

2   comprises a local port on the ingress-forwarding element, and the forwarding further

3   comprises:

4   completing the encapsulation of the packet; and

5   transmitting the packet over the local-egress-port.

1   8.   The machine-accessible medium of claim 6 wherein the egress-port further

2   comprises a remote port, and the forwarding further comprises:

3   forwarding the packet to the egress-forwarding element through an internal bus of

4   the router;

5   applying a label that corresponds to the egress-port and next hop;

6   determining the next hop and the egress-port on which the packet is to be

7   transmitted in reference to the switch-label;

8   removing the label;

9   completing layer-2 encapsulation of the packet; and

10   transmitting the packet over the egress-port.

1   9.   A method to calculate of a routing table comprising:

2   determining the routing table from at least one routing update message; and

3   altering the routing table for each of a plurality of forwarding elements in the

4   router in reference to presence of an egress-port in the forwarding element.

1   10.   The method of claim 9, the method further comprising:

2   determining the presence of an egress-port in the forwarding element.

1   11.   The method of claim 9, wherein the altering further comprises:

2   adding a switch-label corresponding to an actual egress interface to the table,

3   when an egress-port is not present in the forwarding element, wherein the

4   switch-label is unique for every port/next-hop pair on the router.

1   12.   The method of claim 9, wherein the altering further comprises:

2   performing no altering of the routing table for a forwarding element, when an

3   egress-port is present in the forwarding element.

1   13.   A machine-accessible medium having associated instructions capable of directing

2   a machine to perform:

3   determining the routing table from at least one routing update message;

4   determining the presence of an egress-port in the forwarding element; and

5   altering the routing table for each of a plurality of forwarding elements in the

6   router in reference to presence of an egress-port in the forwarding element.

1   14.   The machine-accessible medium of claim 13, wherein the altering further

2   comprises:

3   adding a switch-label corresponding to an actual egress interface to the table,

4   when an egress-port is not present in the forwarding element, wherein the

5   switch-label is unique for every port/next-hop pair on the router.

1   15.   The machine-accessible medium of claim 13, wherein the altering further

2   comprises:

3   performing no altering of the routing table for a forwarding element, when an

4   egress-port is present in the forwarding element.

1   16.   A method to switch at least one internal packet comprising:

2   applying a switch-label to at least one packet, wherein the switch-label uniquely

3   identifies a port/next-hop on the egress-forwarding element of a plurality

4   of forwarding elements that are operably coupled to each other through a

5   transfer connection; and wherein the transfer connection is selected from

6   the group consisting of a single bus, and a switched

7   backplane/interconnect; and

8   transferring the packet between the plurality of forwarding elements.

1   17.   The method of claim 16, wherein the applying is performed by an ingress

2   forwarding element.

1   18.   The method of claim 17, the method further comprising:

2   receiving the packet;

3   removing the switch-label from the packet;

4   completing layer-2 encapsulation of the packet in reference to an external

5   network; and

6   transmitting the packet, wherein the receiving, the removing, the completing and

7   the transmitting are performed by an egress-FE.

1   19.   A machine-accessible medium having associated instructions capable of directing

2   a machine to perform:

3   applying a switch-label to at least one packet, wherein the switch-label uniquely

4   identifies a port/next-hop on the egress-forwarding element of a plurality

5   of forwarding elements that are operably coupled to each other through a

6   transfer connection; and wherein the transfer connection is selected from

7   the group consisting of a single bus, and a switched

8   backplane/interconnect; and

9   transferring the packet between a plurality of forwarding elements.

1   20.   The machine-accessible medium of claim 19, wherein the applying is performed

2   by an ingress forwarding element.

1   21.   The machine-accessible medium of claim 20, the method further comprising:

2   receiving the packet;

3   removing the switch-label from the packet;

4   completing layer-2 encapsulation of the packet in reference to an external

5   network; and

6   transmitting the packet, wherein the receiving, the removing, the completing and

7   the transmitting are performed by an egress-FE.

1   22.   A system comprising:

2   a plurality of forwarding elements; and

3   a control element operably coupled to the plurality of forwarding elements,

4   further comprising a processor and a software means operative on the

5   processor for generating a switch-label table for each forwarding element.

1   23.   The system of claim 22, wherein one of the forwarding elements further

2   comprises an egress forwarding element and another one of the forwarding elements

3   further comprises an ingress forwarding element, which receives packets from an external

4   networking environment, generates a local switch-label and associates the switch label

5   with the packet, the ingress forwarding element further comprises a packet forwarding

6   component that forwards the packet through the apparatus using the switch-label.

1   24.   The system of claim 23, wherein the ingress forwarding element further validates

2   the packet header checksum, decrements the time-to-live indicator by one, and

3   recalculates the header checksum

1   25.   A apparatus comprising:

2   a plurality of forwarding elements; and

3   a control element operably coupled through a switched interconnect/backplane to

4   the plurality of forwarding elements, further comprising a switch-label

5   table manager that generates a switch-label table for each forwarding

6   element.

1   26.   The apparatus of claim 25, wherein one of the forwarding elements further

2   comprises an egress forwarding element and another one of the forwarding elements

3   further comprises an ingress forwarding element, which receives packets from an external

4   networking environment, generates a local switch-label and associates the switch label

5   with the packet, the ingress forwarding element further comprises a packet forwarding

6   component that forwards the packet through the apparatus using the switch-label.

1   27.   The apparatus of claim 26, wherein the ingress forwarding element further

2   validates the packet header checksum, decrements the time-to-live indicator by one, and

3   recalculates the header checksum

1   28.   The apparatus of claim 26, wherein the ingress forwarding element further

2   validates the packet header checksum, decrements the time-to-live indicator by one, and

3   recalculates the header checksum.

1   29.   The apparatus of claim 25, wherein the control element further comprises a route

2   table manager that maintains a routing table.

1   30.   The apparatus of claim 25, wherein the apparatus is a router.